

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-253578

(43)Date of publication of application : 21.09.1999

(51)Int.Cl.

A63B 37/00
A63B 37/04
A63B 37/12
C08L 75/04
C08L101/00
// C08L 23/26

(21)Application number : 10-085025

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(22)Date of filing : 16.03.1998

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(54) MULTI-PIECE SOLID GOLF BALL

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a golf ball which has a favorable carrying characteristic, a soft feeling, and an excellent spin characteristic.

SOLUTION: In a multi-piece solid golf ball provided with a solid core, an intermediate layer, and a cover, the solid core has a 28 mm or larger diameter and the specific gravity thereof is less than 1.3. The intermediate layer is chiefly formed of polyurethane resin and the specific gravity thereof is 1.1 or larger and the Shore D-hardness ranges 25-50. Further, it has a larger specific gravity than the center core. The cover is chiefly made of ionomer resin and the thickness ranges 0.5-3.2 mm and the Shore D-hardness ranges 45-68.

LEGAL STATUS

[Date of request for examination]

22.12.1999

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the
examiner's decision of rejection or application
converted registration]

[Date of final disposal for application]

[Patent number]

3178410

[Date of registration] 13.04.2001

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] Solid core. Interlayer. Covering. It is the multi-piece solid golf ball equipped with the above. the (a) solid core for the diameter of 28mm or more Specific gravity is less than 1.3 and the (b) interlayer is formed considering a polyurethane system resin as main material. 1.1 or more and the Shore D degree of hardness by 25-50 [specific gravity] And it is larger than the specific gravity of the above-mentioned solid core, (c) covering is formed considering an ionomer resin as main material, and thickness is characterized by the Shore D degrees of hardness being 45-68 by 0.5-3.2mm.

[Claim 2] The golf ball according to claim 1 with which the interlayer was formed by the Shore D degree of hardness smaller [six or more] than the surface hardness of a core.

[Claim 3] The golf ball according to claim 1 or 2 whose amount of deflections when applying 130kg load to the sphere which consists of a solid core and an interlayer from the initial load of 10kg is 3.2-5.2mm.

[Claim 4] The golf ball according to claim 1, 2, or 3 with which an interlayer comes to blend a with a specific gravity of three or more minerals bulking agent with a polyurethane system resin, and has specific gravity larger [0.05 or more] than the specific gravity of a solid core.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the multi-piece solid golf ball which has a good jump performance and a spin property, and aimed at improvement in a feeling.

[0002]

[Description of the Prior Art] The golf ball of various structures has come out to the commercial scene from before, and the two-piece solid golf ball which covered the core which makes rubber a base material especially with covering which consists of an ionomer resin etc., and solid or the bobbin golf ball which twisted thread rubber around the liquid pin center, large, and covered this with covering occupies most commercial scenes.

[0003] Since [outstanding] it flies and has a performance and endurance, although the above-mentioned two-piece solid golf ball is used for many general golfers, a feeling of ** is sensed very hard, and it has the fault that it is inferior to a control performance from the speed of the sphere detached building at the time of a blow, and, for this reason, a professional golfer and an amateur upper person have many people who use a bobbin golf ball rather than a two-piece solid golf ball. On the other hand, while a bobbin golf ball is excellent in a feeling and control nature, it has the fault that it is inferior to a two-piece solid golf ball in respect of flight distance and endurance.

[0004] Thus, the two-piece solid golf ball and the bobbin golf ball have the performance which conflicts mutually, and the present condition is that the player has chosen the golf ball used by its **** or liking.

[0005] Now, in the solid golf ball, in order to realize the feeling near a bobbin golf ball, the two-piece solid golf ball soft type is proposed. It is, when [which endurance also falls remarkably while rebounding nature will fall and it will fly if a core is made soft, although a core soft in order to obtain a such soft type two-piece solid golf ball will be used, and a performance falls, and is the feature of a two-piece solid golf ball / outstanding] flying and becoming intolerable to use a performance and endurance not only not being acquired but actual. That is, if structure is determined by optimization of three properties, softness, rebounding nature, and endurance, and the conventional two-piece solid golf ball tends to raise one of performances, other performances will fall.

[0006] Then, the three-piece solid golf ball which intervened the interlayer between a core and covering is proposed variously in recent years. For example, although the thing (JP,6-142228,A) using the polyester system resin as an interlayer, the thing (JP,4-244174,A) using the polyamide system resin, etc. are proposed, flight distance, a feeling, and a spin property (especially spin property in an short iron) are not satisfied enough simultaneously.

[0007] Therefore, although endurance is good and spin is seldom applied in wood crab or a long iron while having a soft and good blow feeling, while initial spin continues good [under a flight] and the good big flight distance of control nature is obtained, a golf ball with which a good spin property is acquired is desired to the blow by the short iron.

[0008] Without having been made in view of the above-mentioned situation, and degrading the good jump performance and good endurance which are the feature of a solid golf ball, this invention has a good spin property, raises a feeling, and aims at offering the multi-piece solid golf ball excellent in total balance.

[0009]

[A The means for solving a technical problem and the form of implementation of invention] this invention person is a solid core (pin center, large core), as a result of inquiring wholeheartedly, in order to attain the above-mentioned purpose. A polyurethane system resin is formed for the interlayer of the solid golf ball which consists of at least three

layers which have an interlayer and covering as main material, In this case, set this interlayer's degree of hardness to 25-50 by the Shore D degree of hardness, and the specific gravity is formed more greatly than the above-mentioned core. Although it has a good flight distance property and a soft feeling and is low spin in wood crab or a long iron enlarging moment of inertia and by using an ionomer resin for covering further and specifying the thickness and the degree of hardness of covering In an short iron, the knowledge of a moderate spin property being acquired is carried out, and it came to make this invention.

[0010] That is, in the multi-piece solid golf ball with which this invention has a solid core, an interlayer, and covering, the (a) solid core is 28mm or more in diameter, and specific gravity is less than 1.3. (b) An interlayer is formed considering a polyurethane system resin as main material, 1.1 or more and the Shore D degree of hardness are 25-50, and its specific gravity is larger than the specific gravity of the above-mentioned solid core, and (c) covering is formed considering an ionomer resin as main material, and offer the multi-piece solid golf ball with which thickness is characterized by the Shore D degrees of hardness being 45-68 by 0.5-3.2mm.

[0011] Hereafter, lessons is taken from this invention and it explains in more detail. The multi-piece solid golf ball of this invention makes the comparatively heavy interlayer who makes a polyurethane system resin the main material intervene between the solid core (pin center, large core) which takes the lead in a ball, and covering of a ball outermost layer of drum.

[0012] Here, as the above-mentioned core, the rubber constituent which blended the joint use bridge agent and the peroxide with base-material rubber can be heated, pressurized and fabricated, and can be manufactured.

[0013] In this case, although the nature and/or synthetic rubber which are used for the solid golf ball from the former can be used as base-material rubber, especially in this invention, 1 and 4-polybutadiene rubber which has cis-structure 90% or more at least 40% or more is desirable. In addition, although natural rubber, a polyisoprene rubber, styrene butadiene rubber, etc. may be suitably blended with this polybutadiene rubber by request, in order to realize high rebounding, it is desirable that 1 which has cis-structure 90% or more, and 4-polybutadiene rubber are contained 90% or more among base-material rubber.

[0014] Although ester compounds, such as zinc salt of unsaturated fatty acid, such as a methacrylic acid and an acrylic acid, magnesium salt, and trimethyl propane trimethacrylate, are used for the solid golf ball and these can be conventionally used for it also in this invention as a joint use bridge agent, acrylic-acid zinc can use it suitable for this invention from the height of rebounding nature. As for the loadings of these joint use bridge agent, it is desirable to consider as 10 - 30 weight section to the above-mentioned base-material rubber 100 weight section.

[0015] As a peroxide, although many things can be selected, the mixture of dicumyl peroxide or dicumyl peroxide, and the 1 and 1-screws (tert-butyl peroxide) 3 and 3 and a 5-trimethyl cyclohexane etc. is suitable. As for the loadings, it is desirable to consider as 0.5 - 1 weight section to the base-material rubber 100 weight section.

[0016] In addition, a zinc oxide, a barium sulfate, etc. can be further blended with specific gravity adjustment if needed, and also an antioxidant etc. can be blended with the above-mentioned rubber constituent.

[0017] The above-mentioned rubber constituent for cores can knead the above-mentioned component using a common kneading machine, for example, a kneader, a Banbury mixer, a roll, etc., can put it into metal mold, and can be obtained by heating, pressurizing and fabricating this at 145-160 degrees C preferably.

[0018] As for the degree of hardness of the above-mentioned solid core, it is desirable that it is 3.2-5.2mm in the amount of deflections when applying 130kg load on the basis of the amount of deflections when applying the initial load of 10kg, and it is 3.8-4.8mm still more preferably 3.5-5.0mm more preferably, this amount of deflections -- 3.2mm -- being small (stiff) -- the case where the feeling at the time of a blow is sensed hard -- it is -- 5.0mm -- being large (soft) -- ball endurance may fall, and rebounding nature may also fall, and a jump performance may fall

[0019] Moreover, the diameter of a solid core is 28mm or more, and is 34-37mm still more preferably 32-38mm more preferably 30-40mm.

[0020] In addition, as for the degree of hardness on the front face of a core, in this invention, it is desirable by the Shore D degree of hardness 30-55, and that it is especially 35-52, and also 44-50. Moreover, especially six or less thing is suitably used for the difference of the Shore D degree of hardness measured at random in the cross section of a core ten or less by the Shore D degree of hardness.

[0021] furthermore, the specific gravity of a core -- less than 1.3 -- it is -- desirable -- 1.0-1.28 -- it is 1.05-1.25 more preferably

[0022] In addition, although a core is usually formed in the single structure of one layer, it can also be formed in the

multilayer structure more than two-layer if needed.

[0023] Next, the interlayer of this invention golf ball is formed considering a polyurethane system resin as main material. In this case, as a polyurethane system resin, a thermoplastic polyurethane elastomer is suitable.

[0024] Here, what the molecular structure becomes from the soft segment which consists of a macromolecule polyol compound, the single chain extension agent which constitutes a hard segment, and diisocyanate can be used for a thermoplastic polyurethane elastomer.

[0025] Especially as a macromolecule polyol compound, it is not restricted, but any of a polyester system polyol, a polyol system polyol, a KOPORI ester system polyol, a polycarbonate system polyol, and a polyether system polyol are sufficient, and the poly caprolactone glycol, the poly (ethylene -1, 4-horse mackerel peat) glycol, the poly (butylene -1, 4-horse mackerel peat) glycol, etc. are mentioned as a polyester system polyol. As a KOPORI ester system polyol, the poly (diethylene-glycol horse mackerel peat) glycol etc. is mentioned. As a polycarbonate system polyol, a glycol (hexandiol -1, 6-carbonate) etc. is mentioned. A polyoxy tetramethylene glycol etc. is mentioned as a polyether system polyol. such number average molecular weight -- about 600-5000 -- it is 1000-3000 preferably

[0026] as diisocyanate -- hexamethylene di-isocyanate (HDI), tolylene diisocyanate (TDI), diphenylmethane diisocyanate (MDI), and Hydrogenation MDI (H12MDI) -- IPDI, CHDI(s), etc. these derivatives, etc. can be used further

[0027] Especially as a chain extension agent, it is not restricted, but usual polyhydric alcohol and amines are used, and 1, 4-butylene glycol, 1, 2-ethylene glycol, 1, 3-propylene glycol, 1, 6-hexyl glycol, 1, 3-butylene glycol, dicyclohexyl methanediamine (hydrogenation MDA), an isophorone diamine (IPDA), etc. are specifically mentioned.

[0028] Although the interlayer of this invention makes the main material the above-mentioned polyurethane system resin (especially thermoplastic polyurethane elastomer) In order to demonstrate the operation effect of this invention further if needed, other thermoplastics etc. can be suitably blended with the above-mentioned thermoplastic polyurethane elastomer, for example, a polyamide elastomer, a polyester elastomer, an ionomer resin, a styrene block elastomer, a hydrogenation polybutadiene, an ethylene vinylacetate copolymer (EVA), a polycarbonate, a polyacrylate, a polyamide, etc. can be blended.

[0029] this invention -- setting -- this interlayer -- the Shore D degree of hardness -- 20-50 -- desirable -- 23-50 -- more -- desirable -- 28-40 -- it forms in 32-38 still more preferably The rebounding nature or endurance of a ball is inferior in the Shore D degree of hardness being less than 20. Moreover, if the Shore D degree of hardness exceeds 50, while a blow feeling will become bad, it comes to be inferior also to rebounding nature.

[0030] in this case, the thing which an interlayer forms more softly than the above-mentioned solid core -- desirable -- especially -- the Shore D degree of hardness -- a solid core -- six or more -- further -- desirable -- 8-15 -- forming small is recommended Thus, by forming an interlayer more softly than a solid core, it has a soft feeling of ** and the moderate feeling of a blow which moreover had the heart, without being too soft can be given.

[0031] moreover, the above-mentioned interlayer -- specific gravity -- 1.1 or more -- desirable -- 1.15-2.0 -- more -- desirable -- 1.2-1.5 -- it forms in 1.22-1.4 still more preferably In this case, this interlayer's specific gravity is formed more greatly than the specific gravity of a solid core. desirable -- the specific gravity of a solid core -- 0.05 or more -- especially -- 0.08-0.15 -- it forms greatly Thereby, the moment of inertia of a ball can be kept large and the attenuation factor of the ball spin in the middle of a flight can be stopped small. Therefore, it will continue till ball fall without the rate of spin immediately after the blow by crab declining so much. For this reason, just before a ball falls on the ground, it is stabilized by the ball, and it can fly.

[0032] Since an interlayer is formed in the above-mentioned specific gravity, in this invention, a minerals bulking agent, especially a with a specific gravity of three or more bulking agent can be blended with a polyurethane system resin. As such a minerals bulking agent, a metal powder, a metallic oxide, a metal nitride, metal carbide, etc. are mentioned. For example, a tungsten (black, specific gravity:19.3), tungsten carbide (dark brown, specific gravity:15.8), molybdenum (gray, specific gravity:10.2), lead (gray, specific gravity:11.3), a lead oxide (dark gray, specific gravity:9.3), nickel (silver gray, specific gravity:8.9) and copper (dark reddish-brown, specific gravity:8.9), or such mixture are illustrated. Although it is desirable to use the bulking agent of the above-mentioned high specific gravity, you may use a barium sulfate with comparatively small specific gravity, a titanium dioxide, or a zinc white.

[0033] Although the above-mentioned interlayer's thickness is selected suitably, it is desirable to be especially referred to as 0.5-2.5mm 0.2-3.0mm.

[0034] In addition, as for the sphere which covers the above-mentioned interlayer and it comes to form on a solid core,

it is desirable that a deflection degree of hardness (value at the time of measuring the amount of deflections at the time of applying a 130kg load after this on the basis of the spherical path at the time of a 10kg initial load) is 3.2-5.2mm, and, thereby, it can obtain a good feeling and good flight distance.

[0035] Although the golf ball of this invention covers the above-mentioned interlayer and covering is formed, this covering can form the ionomer resin usually used as covering material of a solid golf ball as main material. as an ionomer resin -- concrete -- the high lamin 1605 -- said -- 1706 (made in [DEYUPON poly chemical company] Mitsui), and Surlyn 8120 -- said -- 8320 (Du Pont make) etc. can be mentioned and it can also use combining two or more sorts of ionomer resins Moreover, well-known additives, such as a pigment, a dispersant, an antioxidant, an ultraviolet ray absorbent, a UV stabilizer, and a plasticizer, can also be blended with an ionomer resin as occasion demands.

[0036] this covering -- the Shore D degree of hardness -- 45-68 -- desirable -- 50-67 -- it is formed in 55-65 still more preferably The rebounding nature of a ball falls that a covering degree of hardness is less than 45 by the Shore D degree of hardness, and spin is applied too much. On the other hand, if the Shore D degree of hardness exceeds 68, ball endurance will become bad and the feeling at the time of a pat will fall.

[0037] The thickness of covering is 0.5-3.2mm, and is preferably set to 1.2-2.2mm still more preferably 1.0-2.5mm. Covering thickness is inferior to ball endurance in less than 0.5mm, and if rebounding nature may also fall and covering thickness exceeds 3.2mm on the other hand, a feeling of ** will fall.

[0038] In addition, the above-mentioned covering can be formed in the multilayer structure more than two-layer as an one-layer independent layer.

[0039] In this invention, an interlayer can form polyurethane system thermoplastic elastomer compression molding or by carrying out injection molding on a solid core by forming with the constituent made into the main material, as mentioned above.

[0040] On the other hand, although an ionomer resin is formed as main material as a covering material as mentioned above, especially the method of covering covering to an interlayer may not be restricted, may wrap and carry out heating pressing of the interlayer with covering of two sheets usually beforehand fabricated in the shape of semi-sphere husks, or may carry out injection molding of the constituent for covering, and may also wrap in an interlayer.

[0041] Thus, although a dimple is formed in the above-mentioned covering, as the geometric array, the obtained golf balls are eight face pieces, 20 face pieces, etc., and no matter what things, such as the Square type, a hexagon type, the Pentagon type, and a triangle type, may be used for them, they do not interfere as a pattern of a dimple.

[0042] In addition, the golf ball of this invention can follow the diameter, weight can follow a golf ball rule, and it can form in the diameter of 42.67mm or more, and the weight of 45.93g or less. Moreover, when it measures on the conditions mentioned later, as for desirable ball moment of inertia, it is desirable 81 - 86 g-cm² and that it is especially 82 - 85 g-cm².

[0043]

[Effect of the Invention] The multi-piece solid golf ball of this invention has a good flight distance property and a soft feeling, and, moreover, is excellent in the spin property as a golf ball.

[0044]

[Example] Although an example and the example of comparison are shown and this invention is explained concretely hereafter, this invention is not restricted to the following example.

[0045] Covering formation of the interlayer of the composition shown in Table 2 on the solid core of the composition shown in the [example of example and comparison] table 1 was carried out with injection molding, covering formation of the covering of the composition which shows in Table 3 further was carried out with injection molding, and the three-piece solid golf ball of the character shown in Table 4 was manufactured.

[0046] It measured by the following method about the moment of inertia of the obtained golf ball, flight distance, the amount of spin, a feeling, SASAKURE-proof nature, and continuation endurance.

With the SASAKURE-proof nature swing robot, the ball was arbitrarily hit two places by the sand wedge (#SW, head speed 38 m/sec), and visual evaluation of this was carried out.

O :fitness ** : x: Usually, using inferior continuation endurance flywheel blow M/C, it hit repeatedly by head speed 38 m/sec, and some of number of times of a blow until a ball breaks estimated.

O :fitness **:common x : it calculated from the bad moment-of-inertia following formula. That is, moment of inertia is the calculated value calculated from the path (thickness) and specific gravity of each class, and can be searched for by

the following formula by considering that a ball is a globular form. In this case, although the calculation top ball is made into the globular form, since a dimple exists in fact, the specific gravity of a cover layer becomes smaller than an actual covering resin. Here, it is called covering virtual specific gravity and moment-of-inertia M is calculated using this.

$$M = (\pi / 5880000) \times \{(r_1 - r_2) \times D_1^5 + (r_2 - r_3) \times D_2^5 + r_3 \times D_3^5\}$$

M: Moment of inertia (g-cm²)

r1: Core specific-gravity D1: core diameter r2: Interlayer specific gravity D2: interlayer diameter (spherical diameter after forming an interlayer in a core)

r3: Cover-layer virtual specific gravity D3: Cover layer diameter (ball diameter)

* Using mm flight distance swing robot, the unit of each diameter was hit with the driver (#W1, head speed 45 m/sec), and measured a carry and the flight distance of each total.

About amount #Wof spin 1, and #9 iron (#I9, head speed 36 m/sec), a photograph of the behavior of the ball just behind impact was taken, and it computed by photograph resolving.

About feeling #W1 and #I9, the feel when real-**(ing) by three professional golfers was evaluated by the following criteria.

O : -- soft **: -- a little -- stiff x: -- a stiff [0047]

[Table 1]

EXAMPLE

ソリッドコア組成 (重量部)	実施例					比較例			
	1	2	3	4	5	1	2	3	4
ポリブタジエン*1	100	100	100	100	100	100	100	100	100
ジクミルパーオキシ サイド	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
硫酸バリウム	7.6	10.5	8.3	3.3	13.6	18.9	21.1	12.8	20.6
亜鉛華	5	5	5	5	5	5	5	5	5
老化防止剤	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ペンタクロロチオ フェノール亜鉛塩	1	1	1	1	1	1	1	1	1
アクリル酸亜鉛	29.6	24.8	28.1	24.8	26.3	33.3	25.9	34.0	34.0

*1 Japan Synthetic Rubber Co., Ltd. make BR01. [0048]

[Table 2]

SHORE D

中間層組成 (重量部)		ショアD	a	b	c	d	e	f	g	h
	T1190 * 2	40	100		100					
	T1180 * 3	30		100		100	100			
	ハイトレル4047 * 4	40							100	
	PEBAX3533 * 5	42						100		
	ハイミラン1706 * 6	63								60
	サーリン8120 * 7	45								40
	二酸化チタン				6	20				
	タングステン		4.5	14.5			4.5			

*2 Dainippon Ink & Chemicals, Inc. make PanDEKKUSU T1190 (polyurethane system elastomer)

*3 Dainippon Ink & Chemicals, Inc. make PanDEKKUSU T1180 (polyurethane system elastomer)

*4 The Toray Industries Du Pont make Hytrel 4047 (polyester system elastomer)

*5 Toray Industries, Inc. make PEBAX3533 (polyamide system elastomer)

*6 Made in [DEYUPON poly chemical company] Mitsui High MIRAN 1706 (ionomer resin)

*7 Du Pont make Surlyn 8120 (ionomer resin)

[0049]

[Table 3]

カ バ ー 組 成 (<small>重量部</small>)		ショアD	A	B	C	D	E
	ハイミラン1605*8	63		50			
	ハイミラン1706*6	63	55	50		40	70
	サーリン8120*7	45	45		100	60	30
	二酸化チタン		5.13	5.13	5.13	5.13	5.13

*6 Same as the above *7 Same as the above *8 Made in [DEYUPON poly chemical company] Mitsui High MIRAN 1605 (ionomer resin)

[0050]

[Table 4]

		実施例					比較例			
		1	2	3	4	5	1	2	3	4
コア	重量 (g)	27.52	27.62	27.52	26.60	26.54	30.25	27.47	29.72	30.76
	外径 (mm)	36.00	36.00	36.00	36.00	35.30	36.40	35.30	36.50	36.50
	10~130kgたわみ量 (mm)	3.65	4.15	3.70	4.15	3.95	3.00	4.00	2.90	2.90
	ショアD (表面硬度)	50	48	50	48	49	54	48	55	55
	比重	1.127	1.131	1.127	1.089	1.152	1.198	1.193	1.167	1.208
中間層	種類	a	b	c	d	e	f	g	g	h
	硬度 (ショアD)	43	35	43	35	35	42	40	40	56
	重量 (g) * 9	37.86	35.61	37.86	37.86	35.61	38.59	35.66	37.90	37.90
	外径 (mm) * 9	37.90	38.70	39.70	39.70	38.70	40.00	38.70	39.70	39.70
	比重	1.24	1.35	1.24	1.35	1.24	1.01	1.12	1.12	0.98
	ゲージ (mm)	1.85	1.35	1.85	1.85	1.70	1.80	1.70	1.60	1.60
カバー	種類	A	B	A	B	B	C	B	D	E
	比重	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
	ゲージ (mm)	1.50	2.00	1.50	1.50	2.00	1.35	2.00	1.50	1.50
	硬度 (ショアD)	55	63	55	63	63	45	63	53	58
ボール	重量 (g)	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3
	外径 (mm)	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
慣性モーメント (g・cm ²)		83.2	82.9	83.2	84.3	82.3	81.2	81.3	82.1	80.9
# W1 HS45	キャリア (m)	208.8	209.0	208.8	228.7	229.0	205.9	207.9	205.8	207.9
	トータル (m)	222.5	223.5	222.3	223.0	223.3	217.5	221.0	218.1	219.2
	スピンの (rpm)	2702	2565	2651	2499	2528	3001	2548	2898	2689
	フィーリング	○	○	○	○	○	△	○	△	○
# I9 HS36	スピンの (rpm)	9076	8902	9064	8838	8876	9343	8335	8935	8566
	フィーリング	○	○	○	○	○	△	○	○	○
耐ささくれ性		○	○	○	○	○	△	○	△	△
連続耐久性		○	△	○	△	△	○	△	○	○

*9 Core + interlayer.

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TECHNICAL FIELD

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TECHNICAL PROBLEM

[Description of the Prior Art] The golf ball of various structures has come out to the commercial scene from before, and the two-piece solid golf ball which covered the core which makes rubber a base material especially with covering which consists of an ionomer resin etc., and solid or the bobbin golf ball which twisted thread rubber around the liquid pin center, large, and covered this with covering occupies most commercial scenes.

[0003] Since [outstanding] it flies and has a performance and endurance, although the above-mentioned two-piece solid golf ball is used for many general golfers, a feeling of ** is sensed very hard, and it has the fault that it is inferior to a control performance from the speed of the sphere detached building at the time of a blow, and, for this reason, a professional golfer and an amateur upper person have many people who use a bobbin golf ball rather than a two-piece solid golf ball. On the other hand, while a bobbin golf ball is excellent in a feeling and control nature, it has the fault that it is inferior to a two-piece solid golf ball in respect of flight distance and endurance.

[0004] Thus, the two-piece solid golf ball and the bobbin golf ball have the performance which conflicts mutually, and the present condition is that the player has chosen the golf ball used by its **** or liking.

[0005] Now, in the solid golf ball, in order to realize the feeling near a bobbin golf ball, the two-piece solid golf ball soft type is proposed. It is, when [which endurance also falls remarkably while rebounding nature will fall and it will fly if a core is made soft, although a core soft in order to obtain a such soft type two-piece solid golf ball will be used, and a performance falls, and is the feature of a two-piece solid golf ball / outstanding] flying and becoming intolerable to use a performance and endurance not only not being acquired but actual. That is, if structure is determined by optimization of three properties, softness, rebounding nature, and endurance, and the conventional two-piece solid golf ball tends to raise one of performances, other performances will fall.

[0006] Then, the three-piece solid golf ball which intervened the interlayer between a core and covering is proposed variously in recent years. For example, although the thing (JP,6-142228,A) using the polyester system resin as an interlayer, the thing (JP,4-244174,A) using the polyamide system resin, etc. are proposed, flight distance, a feeling, and a spin property (especially spin property in an short iron) are not satisfied enough simultaneously.

[0007] Therefore, although endurance is good and spin is seldom applied in wood crab or a long iron while having a soft and good blow feeling, while initial spin continues good [under a flight] and the good big flight distance of control nature is obtained, a golf ball with which a good spin property is acquired is desired to the blow by the short iron.

[0008] Without having been made in view of the above-mentioned situation, and degrading the good jump performance and good endurance which are the feature of a solid golf ball, this invention has a good spin property, raises a feeling, and aims at offering the multi-piece solid golf ball excellent in total balance.

[0009]

[A The means for solving a technical problem and the form of implementation of invention] this invention person is a solid core (pin center, large core), as a result of inquiring wholeheartedly, in order to attain the above-mentioned purpose. A polyurethane system resin is formed for the interlayer of the solid golf ball which consists of at least three layers which have an interlayer and covering as main material, In this case, set this interlayer's degree of hardness to 25-50 by the Shore D degree of hardness, and the specific gravity is formed more greatly than the above-mentioned core. Although it has a good flight distance property and a soft feeling and is low spin in wood crab or a long iron enlarging moment of inertia and by using an ionomer resin for covering further and specifying the thickness and the degree of hardness of covering In an short iron, the knowledge of a moderate spin property being acquired is carried

out, and it came to make this invention.

[0010] That is, in the multi-piece solid golf ball with which this invention has a solid core, an interlayer, and covering, the (a) solid core is 28mm or more in diameter, and specific gravity is less than 1.3. (b) An interlayer is formed considering a polyurethane system resin as main material, 1.1 or more and the Shore D degree of hardness are 25-50, and its specific gravity is larger than the specific gravity of the above-mentioned solid core, and (c) covering is formed considering an ionomer resin as main material, and offer the multi-piece solid golf ball with which thickness is characterized by the Shore D degrees of hardness being 45-68 by 0.5-3.2mm.

[0011] Hereafter, lessons is taken from this invention and it explains in more detail. The multi-piece solid golf ball of this invention makes the comparatively heavy interlayer who makes a polyurethane system resin the main material intervene between the solid core (pin center, large core) which takes the lead in a ball, and covering of a ball outermost layer of drum.

[0012] Here, as the above-mentioned core, the rubber constituent which blended the joint use bridge agent and the peroxide with base-material rubber can be heated, pressurized and fabricated, and can be manufactured.

[0013] In this case, although the nature and/or synthetic rubber which are used for the solid golf ball from the former can be used as base-material rubber, especially in this invention, 1 and 4-polybutadiene rubber which has cis-structure 90% or more at least 40% or more is desirable. In addition, although natural rubber, a polyisoprene rubber, styrene butadiene rubber, etc. may be suitably blended with this polybutadiene rubber by request, in order to realize high rebounding, it is desirable that 1 which has cis-structure 90% or more, and 4-polybutadiene rubber are contained 90% or more among base-material rubber.

[0014] Although ester compounds, such as zinc salt of unsaturated fatty acid, such as a methacrylic acid and an acrylic acid, magnesium salt, and trimethyl propane trimethacrylate, are used for the solid golf ball and these can be conventionally used for it also in this invention as a joint use bridge agent, acrylic-acid zinc can use it suitable for this invention from the height of rebounding nature. As for the loadings of these joint use bridge agent, it is desirable to consider as 10 - 30 weight section to the above-mentioned base-material rubber 100 weight section.

[0015] As a peroxide, although many things can be selected, the mixture of dicumyl peroxide or dicumyl peroxide, and the 1 and 1-screws (tert-butyl peroxide) 3 and 3 and a 5-trimethyl cyclohexane etc. is suitable. As for the loadings, it is desirable to consider as 0.5 - 1 weight section to the base-material rubber 100 weight section.

[0016] In addition, a zinc oxide, a barium sulfate, etc. can be further blended with specific gravity adjustment if needed, and also an antioxidant etc. can be blended with the above-mentioned rubber constituent.

[0017] The above-mentioned rubber constituent for cores can knead the above-mentioned component using a common kneading machine, for example, a kneader, a Banbury mixer, a roll, etc., can put it into metal mold, and can be obtained by heating, pressurizing and fabricating this at 145-160 degrees C preferably.

[0018] As for the degree of hardness of the above-mentioned solid core, it is desirable that it is 3.2-5.2mm in the amount of deflections when applying 130kg load on the basis of the amount of deflections when applying the initial load of 10kg, and it is 3.8-4.8mm still more preferably 3.5-5.0mm more preferably. this amount of deflections -- 3.2mm -- being small (stiff) -- the case where the feeling at the time of a blow is sensed hard -- it is -- 5.0mm -- being large (soft) -- ball endurance may fall, and rebounding nature may also fall, and a jump performance may fall

[0019] Moreover, the diameter of a solid core is 28mm or more, and is 34-37mm still more preferably 32-38mm more preferably 30-40mm.

[0020] In addition, as for the degree of hardness on the front face of a core, in this invention, it is desirable by the Shore D degree of hardness 30-55, and that it is especially 35-52, and also 44-50. Moreover, especially six or less thing is suitably used for the difference of the Shore D degree of hardness measured at random in the cross section of a core ten or less by the Shore D degree of hardness.

[0021] furthermore, the specific gravity of a core -- less than 1.3 -- it is -- desirable -- 1.0-1.28 -- it is 1.05-1.25 more preferably

[0022] In addition, although a core is usually formed in the single structure of one layer, it can also be formed in the multilayer structure more than two-layer if needed.

[0023] Next, the interlayer of this invention golf ball is formed considering a polyurethane system resin as main material. In this case, as a polyurethane system resin, a thermoplastic polyurethane elastomer is suitable.

[0024] Here, what the molecular structure becomes from the soft segment which consists of a macromolecule polyol compound, the single chain extension agent which constitutes a hard segment, and diisocyanate can be used for a

thermoplastic polyurethane elastomer.

[0025] Especially as a macromolecule polyol compound, it is not restricted, but any of a polyester system polyol, a polyol system polyol, a KOPORI ester system polyol, a polycarbonate system polyol, and a polyether system polyol are sufficient, and the poly caprolactone glycol, the poly (ethylene -1, 4-horse mackerel peat) glycol, the poly (butylene -1, 4-horse mackerel peat) glycol, etc. are mentioned as a polyester system polyol. As a KOPORI ester system polyol, the poly (diethylene-glycol horse mackerel peat) glycol etc. is mentioned. As a polycarbonate system polyol, a glycol (hexandiol -1, 6-carbonate) etc. is mentioned. A polyoxy tetramethylene glycol etc. is mentioned as a polyether system polyol. such number average molecular weight -- about 600-5000 -- it is 1000-3000 preferably

[0026] as diisocyanate -- hexamethylene di-isocyanate (HDI), tolylene diisocyanate (TDI), diphenylmethane diisocyanate (MDI), and Hydrogenation MDI (H12MDI) -- IPDI, CHDI(s), etc. these derivatives, etc. can be used further

[0027] Especially as a chain extension agent, it is not restricted, but usual polyhydric alcohol and amines are used, and 1, 4-butylene glycol, 1, 2-ethylene glycol, 1, 3-propylene glycol, 1, 6-hexyl glycol, 1, 3-butylene glycol, dicyclohexyl methanediamine (hydrogenation MDA), an isophorone diamine (IPDA), etc. are specifically mentioned.

[0028] Although the interlayer of this invention makes the main material the above-mentioned polyurethane system resin (especially thermoplastic polyurethane elastomer) In order to demonstrate the operation effect of this invention further if needed, other thermoplastics etc. can be suitably blended with the above-mentioned thermoplastic polyurethane elastomer, for example, a polyamide elastomer, a polyester elastomer, an ionomer resin, a styrene block elastomer, a hydrogenation polybutadiene, an ethylene vinylacetate copolymer (EVA), a polycarbonate, a polyacrylate, a polyamide, etc. can be blended.

[0029] this invention -- setting -- this interlayer -- the Shore D degree of hardness -- 20-50 -- desirable -- 23-50 -- more -- desirable -- 28-40 -- it forms in 32-38 still more preferably The rebounding nature or endurance of a ball is inferior in the Shore D degree of hardness being less than 20. Moreover, if the Shore D degree of hardness exceeds 50, while a blow feeling will become bad, it comes to be inferior also to rebounding nature.

[0030] in this case, the thing which an interlayer forms more softly than the above-mentioned solid core -- desirable -- especially -- the Shore D degree of hardness -- a solid core -- six or more -- further -- desirable -- 8-15 -- forming small is recommended Thus, by forming an interlayer more softly than a solid core, it has a soft feeling of ** and the moderate feeling of a blow which moreover had the heart, without being too soft can be given.

[0031] moreover, the above-mentioned interlayer -- specific gravity -- 1.1 or more -- desirable -- 1.15-2.0 -- more -- desirable -- 1.2-1.5 -- it forms in 1.22-1.4 still more preferably In this case, this interlayer's specific gravity is formed more greatly than the specific gravity of a solid core. desirable -- the specific gravity of a solid core -- 0.05 or more -- especially -- 0.08-0.15 -- it forms greatly Thereby, the moment of inertia of a ball can be kept large and the attenuation factor of the ball spin in the middle of a flight can be stopped small. Therefore, it will continue till ball fall without the rate of spin immediately after the blow by crab declining so much. For this reason, just before a ball falls on the ground, it is stabilized by the ball, and it can fly.

[0032] Since an interlayer is formed in the above-mentioned specific gravity, in this invention, a minerals bulking agent, especially a with a specific gravity of three or more bulking agent can be blended with a polyurethane system resin. As such a minerals bulking agent, a metal powder, a metallic oxide, a metal nitride, metal carbide, etc. are mentioned. For example, a tungsten (black, specific gravity:19.3), tungsten carbide (dark brown, specific gravity:15.8), molybdenum (gray, specific gravity:10.2), lead (gray, specific gravity:11.3), a lead oxide (dark gray, specific gravity:9.3), nickel (silver gray, specific gravity:8.9) and copper (dark reddish-brown, specific gravity:8.9), or such mixture are illustrated. Although it is desirable to use the bulking agent of the above-mentioned high specific gravity, you may use a barium sulfate with comparatively small specific gravity, a titanium dioxide, or a zinc white.

[0033] Although the above-mentioned interlayer's thickness is selected suitably, it is desirable to be especially referred to as 0.5-2.5mm 0.2-3.0mm.

[0034] In addition, as for the sphere which covers the above-mentioned interlayer and it comes to form on a solid core, it is desirable that a deflection degree of hardness (value at the time of measuring the amount of deflections at the time of applying a 130kg load after this on the basis of the spherical path at the time of a 10kg initial load) is 3.2-5.2mm, and, thereby, it can obtain a good feeling and good flight distance.

[0035] Although the golf ball of this invention covers the above-mentioned interlayer and covering is formed, this covering can form the ionomer resin usually used as covering material of a solid golf ball as main material. as an

ionomer resin -- concrete -- the high lamin 1605 -- said -- 1706 (made in [DEYUPON poly chemical company] Mitsui), and Surlyn 8120 -- said -- 8320 (Du Pont make) etc. can be mentioned and it can also use combining two or more sorts of ionomer resins Moreover, well-known additives, such as a pigment, a dispersant, an antioxidant, an ultraviolet ray absorbent, a UV stabilizer, and a plasticizer, can also be blended with an ionomer resin as occasion demands.

[0036] this covering -- the Shore D degree of hardness -- 45-68 -- desirable -- 50-67 -- it is formed in 55-65 still more preferably The rebounding nature of a ball falls that a covering degree of hardness is less than 45 by the Shore D degree of hardness, and spin is applied too much. On the other hand, if the Shore D degree of hardness exceeds 68, ball endurance will become bad and the feeling at the time of a pat will fall.

[0037] The thickness of covering is 0.5-3.2mm, and is preferably set to 1.2-2.2mm still more preferably 1.0-2.5mm. Covering thickness is inferior to ball endurance in less than 0.5mm, and if rebounding nature may also fall and covering thickness exceeds 3.2mm on the other hand, a feeling of ** will fall.

[0038] In addition, the above-mentioned covering can be formed in the multilayer structure more than two-layer as an one-layer independent layer.

[0039] In this invention, an interlayer can form polyurethane system thermoplastic elastomer compression molding or by carrying out injection molding on a solid core by forming with the constituent made into the main material, as mentioned above.

[0040] On the other hand, although an ionomer resin is formed as main material as a covering material as mentioned above, especially the method of covering covering to an interlayer may not be restricted, may wrap and carry out heating pressing of the interlayer with covering of two sheets usually beforehand fabricated in the shape of semi-sphere husks, or may carry out injection molding of the constituent for covering, and may also wrap in an interlayer.

[0041] Thus, although a dimple is formed in the above-mentioned covering, as the geometric array, the obtained golf balls are an 8th page object, a 20th page object, etc., and no matter what things, such as the Square type, a hexagon type, the Pentagon type, and a triangle type, may be used for them, they do not interfere as a pattern of a dimple.

[0042] In addition, the golf ball of this invention can follow the diameter, weight can follow a golf ball rule, and it can form in the diameter of 42.67mm or more, and the weight of 45.93g or less. Moreover, when it measures on the conditions mentioned later, as for desirable ball moment of inertia, it is desirable 81 - 86 g-cm² and that it is especially 82 - 85 g-cm².

[Translation done.]

* NOTICES *

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EXAMPLE

[Example] Although an example and the example of comparison are shown and this invention is explained concretely hereafter, this invention is not restricted to the following example.

[0045] Covering formation of the interlayer of the composition shown in Table 2 on the solid core of the composition shown in the [example of example and comparison] table 1 was carried out with injection molding, covering formation of the covering of the composition which shows in Table 3 further was carried out with injection molding, and the three-piece solid golf ball of the character shown in Table 4 was manufactured.

[0046] It measured by the following method about the moment of inertia of the obtained golf ball, flight distance, the amount of spin, a feeling, SASAKURE-proof nature, and continuation endurance.

With the SASAKURE-proof nature swing robot, the ball was arbitrarily hit two places by the sand wedge (#SW, head speed 38 m/sec), and visual evaluation of this was carried out.

O :fitness **: x: Usually, using inferior continuation endurance flywheel blow M/C, it hit repeatedly by head speed 38 m/sec, and some of number of times of a blow until a ball breaks estimated.

O :good **:common x : it calculated from the bad moment-of-inertia following formula. That is, moment of inertia is the calculated value calculated from the path (thickness) and specific gravity of each class, and can be searched for by the following formula by considering that a ball is a globular form. In this case, although the calculation top ball is made into the globular form, since a dimple exists in fact, the specific gravity of a cover layer becomes smaller than an actual covering resin. Here, it is called covering virtual specific gravity and moment-of-inertia M is calculated using this.

$$M = (\pi / 5880000) \times \{ (r1 - r2) \times D1^5 + (r2 - r3) \times D2^5 + r3 \times D3^5 \}$$

M: Moment of inertia (g-cm²)

r1: Core specific-gravity D1: core diameter r2: Interlayer specific gravity D2: interlayer diameter (spherical diameter after forming an interlayer in a core)

r3: Cover-layer virtual specific gravity D3: Cover layer diameter (ball diameter)

* Using mm flight distance swing robot, the unit of each diameter was hit with the driver (#W1, head speed 45 m/sec), and measured a carry and the flight distance of each total.

About amount #W of spin 1, and #9 iron (#I9, head speed 36 m/sec), a photograph of the behavior of the ball just behind impact was taken, and it computed by photograph resolving.

About feeling #W1 and #I9, the feel when real-**(ing) by three professional golfers was evaluated by the following criteria.

O : -- soft **: -- a little -- stiff x: -- a stiff [0047]

[Table 1]

ソリッドコア組成 (重量部)	実施例					比較例			
	1	2	3	4	5	1	2	3	4
ポリブタジエン*1	100	100	100	100	100	100	100	100	100
ジクミルパーオキサイド	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
硫酸バリウム	7.6	10.5	8.3	3.3	13.6	18.9	21.1	12.8	20.6
亜鉛華	5	5	5	5	5	5	5	5	5
老化防止剤	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ペンタクロロチオフェノール亜鉛塩	1	1	1	1	1	1	1	1	1
アクリル酸亜鉛	29.6	24.8	28.1	24.8	26.3	33.3	25.9	34.0	34.0

*1 Japan Synthetic Rubber Co., Ltd. make BR01. [0048]

[Table 2]

中間層組成 (重量部)		ショアD	a	b	c	d	e	f	g	h
	T1190*2	40	100		100					
	T1180*3	30		100		100	100			
	ハイトレル4047*4	40							100	
	PEBAX3533*5	42						100		
	ハイミラン1706*6	63								60
	サーリン8120*7	45								40
	二酸化チタン				6	20				
	タングステン		4.5	14.5			4.5			

*2 Dainippon Ink & Chemicals, Inc. make PanDEKKUSU T1190 (polyurethane system elastomer)

*3 Dainippon Ink & Chemicals, Inc. make PanDEKKUSU T1180 (polyurethane system elastomer)

*4 The Toray Industries Du Pont make Hytrel 4047 (polyester system elastomer)

*5 Toray Industries, Inc. make PEBAX3533 (polyamide system elastomer)

*6 Made in [DEYUPON poly chemical company] Mitsui High MIRAN 1706 (ionomer resin)

*7 Du Pont make Surlyn 8120 (ionomer resin)

[0049]

[Table 3]

カバー組成 (重量部)		ショアD	A	B	C	D	E
	ハイミラン1805*8	63		50			
	ハイミラン1706*6	63	55	50		40	70
	サーリン8120*7	45	45		100	60	30
	二酸化チタン		5.13	5.13	5.13	5.13	5.13

*6 Same as the above *7 Same as the above *8 Made in [DEYUPON poly chemical company] Mitsui High MIRAN

1605 (ionomer resin)

[0050]

[Table 4]

		実施例					比較例			
		1	2	3	4	5	1	2	3	4
コア	重量 (g)	27.52	27.62	27.52	26.60	26.54	30.25	27.47	29.72	30.76
	外径 (mm)	36.00	36.00	36.00	36.00	35.30	36.40	35.30	36.50	36.50
	10~130kgたわみ量 (mm)	3.65	4.15	3.70	4.15	3.95	3.00	4.00	2.90	2.90
	ショアD (表面硬度)	50	48	50	48	49	54	48	55	55
	比重	1.127	1.131	1.127	1.089	1.152	1.198	1.193	1.167	1.208
中間層	種類	a	b	c	d	e	f	g	g	h
	硬度 (ショアD)	43	35	43	35	35	42	40	40	56
	重量 (g) * 9	37.86	35.61	37.86	37.86	35.61	38.59	35.66	37.90	37.90
	外径 (mm) * 9	37.90	38.70	39.70	39.70	38.70	40.00	38.70	39.70	39.70
	比重	1.24	1.35	1.24	1.35	1.24	1.01	1.12	1.12	0.98
	ゲージ (mm)	1.85	1.35	1.85	1.85	1.70	1.80	1.70	1.60	1.60
カバー	種類	A	B	A	B	B	C	B	D	E
	比重	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
	ゲージ (mm)	1.50	2.00	1.50	1.50	2.00	1.35	2.00	1.50	1.50
	硬度 (ショアD)	55	63	55	63	63	45	63	53	58
ボール	重量 (g)	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3
	外径 (mm)	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
慣性モーメント (g・cm ²)		83.2	82.9	83.2	84.3	82.3	81.2	81.3	82.1	80.9
# W1 HS45	キャリア (m)	208.8	209.0	208.8	228.7	229.0	205.9	207.9	205.8	207.9
	トータル (m)	222.5	223.5	222.3	223.0	223.3	217.5	221.0	218.1	219.2
	スピン (rpm)	2702	2565	2651	2499	2528	3001	2548	2898	2689
	フィーリング	○	○	○	○	○	△	○	△	○
# I9 HS36	スピン (rpm)	9076	8902	9064	8838	8876	9343	8335	8935	8566
	フィーリング	○	○	○	○	○	△	○	○	○
耐ささくれ性		○	○	○	○	○	△	○	△	△
連続耐久性		○	△	○	△	△	○	△	○	○

*9 Core + interlayer.

[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平11-253578

(43) 公開日 平成11年(1999) 9月21日

(51) Int.Cl. ⁸	識別記号	F I	
A 6 3 B 37/00		A 6 3 B 37/00	L
	37/04		37/04
	37/12		37/12
C 0 8 L 75/04		C 0 8 L 75/04	
	101/00		101/00
審査請求 未請求 請求項の数 4 F D (全 8 頁) 最終頁に続く			

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(54) 【発明の名称】 マルチピースソリッドゴルフボール

(57) 【要約】

【解決手段】 ソリッドコアと、中間層と、カバーとを有するマルチピースソリッドゴルフボールにおいて、

(a) ソリッドコアが直径28mm以上で、比重が1.3未満であり、(b) 中間層がポリウレタン系樹脂を主材として形成され、比重が1.1以上、ショアD硬度が25～50で、かつ上記センターコアの比重より大きく、(c) カバーがアイオノマー樹脂を主材として形成され、厚さが0.5～3.2mmで、ショアD硬度が45～68であることを特徴とするマルチピースソリッドゴルフボール。

【効果】 本発明のマルチピースソリッドゴルフボールは、良好な飛距離特性、ソフトなフィーリングを有し、しかもゴルフボールとしてのスピン特性に優れたものである。

【特許請求の範囲】

【請求項1】 ソリッドコアと、中間層と、カバーとを有するマルチピースソリッドゴルフボールにおいて、

(a) ソリッドコアが直径28mm以上で、比重が1.3未満であり、(b) 中間層がポリウレタン系樹脂を主材として形成され、比重が1.1以上、ショアD硬度が25～50で、かつ上記ソリッドコアの比重より大きく、(c) カバーがアイオノマー樹脂を主材として形成され、厚さが0.5～3.2mmで、ショアD硬度が45～68であることを特徴とするマルチピースソリッドゴルフボール。

【請求項2】 中間層が、ショアD硬度でコアの表面硬度より6以上小さく形成された請求項1記載のゴルフボール。

【請求項3】 ソリッドコアと中間層とからなる球体に10kg初期荷重から130kg荷重をかけたときのたわみ量が3.2～5.2mmである請求項1又は2記載のゴルフボール。

【請求項4】 中間層が、ポリウレタン系樹脂に比重3以上の無機質充填剤を配合してなるものであり、ソリッドコアの比重より0.05以上大きい比重を有する請求項1、2又は3記載のゴルフボール。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、良好な飛び性能及びスピン特性を有し、かつフィーリングの向上を図ったマルチピースソリッドゴルフボールに関する。

【0002】

【従来の技術及び発明が解決しようとする課題】従来より、種々の構造のゴルフボールが市場にでており、中でもゴムを基材とするコアをアイオノマー樹脂等からなるカバーで被覆したツーピースソリッドゴルフボールと、ソリッド又はリキッドセンターに糸ゴムを巻きつけ、これをカバーで被覆した糸巻ゴルフボールとが市場の大半を占めている。

【0003】上記ツーピースソリッドゴルフボールは、優れた飛び性能及び耐久性を有することから、多くの一般ゴルファーに使用されているが、打感が非常に硬く感じられ、また打撃時の球離れの速さからコントロール性能に劣るという欠点を有し、このためプロゴルファーやアマチュア上級者は、ツーピースソリッドゴルフボールよりも糸巻ゴルフボールを使用する人が多い。一方、糸巻ゴルフボールは、フィーリング、コントロール性に優れた反面、飛距離、耐久性の点でツーピースソリッドゴルフボールに劣るという欠点がある。

【0004】このように、ツーピースソリッドゴルフボールと糸巻ゴルフボールとは、互いに相反する性能を有しており、プレーヤーは自分の技術や好みにより使用するゴルフボールを選択しているのが現状である。

【0005】現在、ソリッドゴルフボールにおいて、糸

巻ゴルフボールに近いフィーリングを実現するため、軟らかいタイプのツーピースソリッドゴルフボールが提案されている。このような軟らかいタイプのツーピースソリッドゴルフボールを得るためには、軟らかいコアを用いることになるが、コアを軟らかくすると、反跳性が低下して飛び性能が低下すると共に、耐久性も著しく低下し、ツーピースソリッドゴルフボールの特徴である優れた飛び性能及び耐久性が得られないばかりでなく、実際の使用に耐え難くなってしまう場合もある。即ち、従来のツーピースソリッドゴルフボールは、軟らかさ、反跳性及び耐久性の3つの特性の最適化により構造が決定され、いずれかの性能を向上させようとすれば他の性能が低下してしまうものである。

【0006】そこで近年、コアとカバーとの間に中間層を介在したスリーピースソリッドゴルフボールが種々提案されている。例えば、中間層としてポリエステル系樹脂を用いたもの(特開平6-142228号公報)、ポリアミド系樹脂を用いたもの(特開平4-244174号公報)などが提案されているが、飛距離、フィーリング、スピン特性(特にショートアイアンでのスピン特性)を同時に十分満足させるものではない。

【0007】従って、ソフトで良好な打撃フィーリングを有すると共に、耐久性が良く、かつウッドクラブやロングアイアンではスピニングがあまりかからないが、初期スピニングが飛行中良好に持続してコントロール性の良い大きな飛距離が得られる一方、ショートアイアンによる打撃では良好なスピン特性が得られるゴルフボールが望まれている。

【0008】本発明は、上記事情に鑑みなされたもので、ソリッドゴルフボールの特徴である良好な飛び性能及び耐久性を劣化させることなく、良好なスピン特性を有し、フィーリングを向上させ、トータルバランスに優れたマルチピースソリッドゴルフボールを提供することを目的とする。

【0009】

【課題を解決するための手段及び発明の実施の形態】本発明者は、上記目的を達成するため鋭意検討を行った結果、ソリッドコア(センターコア)と、中間層と、カバーとを有する少なくとも3層からなるソリッドゴルフボールの中間層をポリウレタン系樹脂を主材として形成すること、この場合、この中間層の硬度をショアD硬度で25～50とし、かつその比重を上記コアより大きく形成して、慣性モーメントを大きくすること、更にカバーにアイオノマー樹脂を用い、カバーの厚さ及び硬度を特定することにより、良好な飛距離特性、ソフトなフィーリングを有し、かつウッドクラブやロングアイアンでは低スピンであるが、ショートアイアンでは適度なスピン特性が得られることを知見し、本発明をなすに至った。

【0010】即ち、本発明は、ソリッドコアと、中間層と、カバーとを有するマルチピースソリッドゴルフボー

ルにおいて、(a)ソリッドコアが直径28mm以上で、比重が1.3未満であり、(b)中間層がポリウレタン系樹脂を主材として形成され、比重が1.1以上、ショアD硬度が25~50で、かつ上記ソリッドコアの比重より大きく、(c)カバーがアイオノマー樹脂を主材として形成され、厚さが0.5~3.2mmで、ショアD硬度が45~68であることを特徴とするマルチピースソリッドゴルフボールを提供する。

【0011】以下、本発明につき更に詳しく説明する。本発明のマルチピースソリッドゴルフボールは、ボールの中心となるソリッドコア(センターコア)と、ボール最外層のカバーとの間に、ポリウレタン系樹脂を主材とする比較的重い中間層を介在させたものである。

【0012】ここで、上記コアとしては、基材ゴムに共架橋剤、過酸化物を配合したゴム組成物を加熱、加圧、成形して製造することができる。

【0013】この場合、基材ゴムとしては、従来からソリッドゴルフボールに用いられている天然及び/又は合成ゴムを使用することができるが、本発明においては、シス構造を少なくとも40%以上、特に90%以上有する1,4-ポリブタジエンゴムが好ましい。なお、所望により該ポリブタジエンゴムに天然ゴム、ポリイソプレンゴム、スチレンブタジエンゴム等を適宜配合してもよいが、高反発を実現するためにシス構造を90%以上有する1,4-ポリブタジエンゴムが基材ゴム中90%以上含まれていることが好ましい。

【0014】共架橋剤としては、従来ソリッドゴルフボールには、メタクリル酸、アクリル酸等の不飽和脂肪酸の亜鉛塩、マグネシウム塩やトリメチルプロパントリメタクリレート等のエステル化合物が使用されており、本発明においてもこれらを使用することができるが、反発性の高さよりアクリル酸亜鉛が本発明に好適に使用し得る。これら共架橋剤の配合量は、上記基材ゴム100重量部に対し10~30重量部とすることが好ましい。

【0015】過酸化物としては、種々選定し得るが、ジクミルパーオキシド或いはジクミルパーオキシドと1,1-ビス(4-tert-ブチルパーオキシ)3,3,5-トリメチルシクロヘキサンの混合物などが好適である。その配合量は、基材ゴム100重量部に対し0.5~1重量部とすることが好ましい。

【0016】なお、上記ゴム組成物には、更に必要に応じて比重調整に酸化亜鉛や硫酸バリウムなどを配合し得るほか、老化防止剤等も配合することができる。

【0017】上記コア用ゴム組成物は、上記成分を一般的な混練り機、例えばニーダー、バンバリミキサーやロール等を用いて混練りし、金型に入れ、これを好ましくは145~160℃にて加熱、加圧、成形することにより得ることができる。

【0018】上記ソリッドコアの硬度は、10kg初期荷重をかけたときのたわみ量を基準とし、それから13

0kg荷重をかけたときのたわみ量で3.2~5.2mmであることが好ましく、より好ましくは3.5~5.0mm、更に好ましくは3.8~4.8mmである。このたわみ量が3.2mmより小さい(硬い)と、打撃時のフィーリングが硬く感じられる場合があり、5.0mmより大きい(軟らかい)と、ボール耐久性が低下し、また反発性も低下し、飛び性能が低下する場合がある。

【0019】また、ソリッドコアの直径は28mm以上であり、好ましくは30~40mm、より好ましくは32~38mm、更に好ましくは34~37mmである。

【0020】なお、本発明において、コア表面の硬度はショアD硬度で30~55、特に35~52、更には44~50であることが好ましい。また、コアの断面でランダムに測定したショアD硬度の差が、ショアD硬度で10以下、特に6以下のものが好適に用いられる。

【0021】更に、コアの比重は、1.3未満であり、好ましくは1.0~1.28、より好ましくは1.05~1.25である。

【0022】なお、コアは、通常1層の単一構造に形成されるが、必要に応じて2層以上の多層構造に形成することもできる。

【0023】次に、本発明ゴルフボールの中間層は、ポリウレタン系樹脂を主材として形成される。この場合、ポリウレタン系樹脂としては、熱可塑性ポリウレタンエラストマーが好適である。

【0024】ここで、熱可塑性ポリウレタンエラストマーは、その分子構造が、高分子ポリオール化合物からなるソフトセグメントと、ハードセグメントを構成する単分子鎖延長剤と、ジイソシアネートとからなるものを用いることができる。

【0025】高分子ポリオール化合物としては、特に制限されず、ポリエステル系ポリオール、ポリオール系ポリオール、コポリエステル系ポリオール、ポリカーボネート系ポリオール、ポリエーテル系ポリオールのいずれでもよく、ポリエステル系ポリオールとしては、ポリカプロラクトングリコール、ポリ(エチレン-1,4-アジペート)グリコール、ポリ(ブチレン-1,4-アジペート)グリコール等が挙げられる。コポリエステル系ポリオールとしては、ポリ(ジエチレングリコールアジペート)グリコール等が挙げられる。ポリカーボネート系ポリオールとしては、(ヘキサジオール-1,6-カーボネート)グリコール等が挙げられる。ポリエーテル系ポリオールとしては、ポリオキシテトラメチレングリコール等が挙げられる。これらの数平均分子量は約600~5000、好ましくは1000~3000である。

【0026】ジイソシアネートとしては、ヘキサメチレンジイソシアネート(HDI)、トリレンジイソシアネート(TDI)、ジフェニルメタンジイソシアネート(MDI)、水素添加MDI(H₁₂MDI)、更にはI

PDI、CHDIなどや、これらの誘導体等を用いることができる。

【0027】鎖延長剤としては、特に制限されず、通常の高価アルコール類、アミン類が用いられ、具体的には1,4-ブチレングリコール、1,2-エチレングリコール、1,3-プロピレングリコール、1,6-ヘキシルグリコール、1,3-ブチレングリコール、ジシクロヘキシルメタンジアミン(水添MDA)、イソホロンジアミン(IPDA)などが挙げられる。

【0028】本発明の中間層は、上記ポリウレタン系樹脂(特に熱可塑性ポリウレタンエラストマー)を主材とするが、必要に応じ、本発明の作用効果を更に発揮させるために、上記熱可塑性ポリウレタンエラストマーには他の熱可塑性樹脂などを適宜配合することができ、例えばポリアミドエラストマー、ポリエステルエラストマー、アイオノマー樹脂、スチレンブロックエラストマー、水添ポリブタジエン、エチレン-酢酸ビニル共重合体(EVA)、ポリカーボネート、ポリアクリレート、ポリアミドなどを配合し得る。

【0029】本発明において、この中間層はショアD硬度が20~50、好ましくは23~50、より好ましくは28~40、更に好ましくは32~38に形成する。ショアD硬度が20未満であると、ボールの反跳性或いは耐久性が劣る。また、ショアD硬度が50を超えると打撃フィーリングが悪くなると共に、反跳性にも劣るようになる。

【0030】この場合、中間層は、上記ソリッドコアよりも軟らかく形成することが好ましく、特にショアD硬度でソリッドコアより6以上、更に好ましくは8~15小さく形成することが推奨される。このように中間層をソリッドコアより軟らかく形成することで、ソフトな打感を有し、しかも軟らかすぎずに芯を持った適度な打撃感を与えることができる。

【0031】また、上記中間層は、比重が1.1以上、好ましくは1.15~2.0、より好ましくは1.2~1.5、更に好ましくは1.22~1.4に形成する。この場合、この中間層の比重は、ソリッドコアの比重よりも大きく形成する。好ましくは、ソリッドコアの比重より0.05以上、特に0.08~0.15大きく形成する。これにより、ボールの慣性モーメントを大きく保ち、飛行途中のボールスピンの減衰率を小さく抑えることができる。従って、クラブによる打撃直後のスピン率がそれほど減衰しないでボール落下時まで持続することになる。このため、ボールが地上に落下する直前でも、ボールが安定して飛行できる。

【0032】上記した比重に中間層を形成するため、本発明ではポリウレタン系樹脂に無機質充填剤、特に比重3以上の充填剤を配合することができる。このような無機質充填剤としては、金属粉、金属酸化物、金属窒化物、金属炭化物等が挙げられる。例えば、タングステン

(黒、比重:19.3)、タングステンカーバイト(黒褐色、比重:15.8)、モリブデン(灰色、比重:10.2)、鉛(灰色、比重:11.3)、酸化鉛(暗灰色、比重:9.3)、ニッケル(銀灰色、比重:8.9)及び銅(赤褐色、比重:8.9)又はこれらの混合物などが例示される。上記高比重の充填剤を用いるのが好ましいが、比較的比重の小さい硫酸バリウム、二酸化チタン、又は亜鉛華を用いても良い。

【0033】上記中間層の厚さは適宜選定されるが、0.2~3.0mm、特に0.5~2.5mmとすることが好ましい。

【0034】なお、ソリッドコア上に上記中間層を被覆、形成してなる球体は、たわみ硬度(10kgの初期荷重時の球体の径を基準とし、これから130kgの荷重をかけた際のたわみ量を計測した際の値)が3.2~5.2mmであることが好ましく、これにより良好なフィーリングと飛距離とを得ることができる。

【0035】本発明のゴルフボールは、上記中間層を被覆してカバーを形成するが、このカバーは、ソリッドゴルフボールのカバー材として通常使用されるアイオノマー樹脂を主材として形成することができる。アイオノマー樹脂として具体的にはハイラミン1605、同1706(三井・デュボンポリケミカル社製)、サーリン8120、同8320(デュボン社製)等を挙げることができる。2種以上のアイオノマー樹脂を組み合わせて用いることもできる。また、必要により、アイオノマー樹脂に顔料、分散剤、酸化防止剤、紫外線吸収剤、紫外線安定剤、可塑剤等の公知の添加剤を配合することもできる。

【0036】このカバーは、ショアD硬度で45~68、好ましくは50~67、更に好ましくは55~65に形成される。カバー硬度がショアD硬度で45未満であると、ボールの反跳性が低下し、またスピンのかかりすぎる。一方、ショアD硬度が68を超えると、ボール耐久性が悪くなり、またバッティング時のフィーリングが低下する。

【0037】カバーの厚さは0.5~3.2mmであり、好ましくは1.0~2.5mm、更に好ましくは1.2~2.2mmとする。カバー厚さが0.5mm未満ではボール耐久性に劣り、反跳性も低下する場合があり、一方、カバー厚さが3.2mmを超えると、打感が低下する。

【0038】なお、上記カバーは、1層の単独層として、又は2層以上の多層構造に形成することができる。

【0039】本発明において、中間層は上述したようにポリウレタン系熱可塑性エラストマーを主材とした組成物で形成することで、ソリッドコア上に圧縮成形又は射出成形することによって形成することができる。

【0040】一方、カバー材料としては、上述したようにアイオノマー樹脂を主材として形成するが、カバーを中間層に被覆する方法は特に制限されず、通常は予め半

球殻状に成形した2枚のカバーで中間層を包み、加熱加圧成形するか、カバー用組成物を射出成形して中間層を包み込んでもよい。

【0041】このようにして得られたゴルフボールは、上記カバーにディンプルを形成するが、その幾何学的配列としては、8面体、20面体などで、ディンプルの模様としては、スクウェア型、ヘキサゴン型、ペンタゴン型、トライアングル型などのいかなるものを採用しても差し支えない。

【0042】なお、本発明のゴルフボールは、その直径、重さはゴルフボール規則に従い、直径42.67mm以上、重量45.93g以下に形成することができる。また、好ましいボール慣性モーメントは、後述する条件で測定した場合、81~86g・cm²、特に82~85g・cm²であることが好ましい。

【0043】

【発明の効果】本発明のマルチピースソリッドゴルフボールは、良好な飛距離特性、ソフトなフィーリングを有し、しかもゴルフボールとしてのスピン特性に優れたものである。

【0044】

【実施例】以下、実施例と比較例を示し、本発明を具体的に説明するが、本発明は下記の実施例に制限されるものではない。

【0045】〔実施例、比較例〕表1に示す組成のソリッドコア上に表2に示す組成の中間層を射出成形により被覆形成し、更に表3に示す組成のカバーを射出成形により被覆形成して、表4に示す性状のスリーピースソリッドゴルフボールを製造した。

【0046】得られたゴルフボールの慣性モーメント、飛距離、スピン量、フィーリング、耐ササクレ性、連続耐久性について下記方法で測定した。

耐ササクレ性

スイングロボットにより、サンドウェッジ（#SW、ヘッドスピード38m/sec）でボールを任意に二箇所打撃し、これを目視評価した。

○：良好

△：普通

×：劣る

連続耐久性

フライホイール打撃M/Cを用い、ヘッドスピード38

m/secで繰り返し打撃して、ボールが破壊するまでの打撃回数の多少により評価した。

○：良好

△：普通

×：悪い

慣性モーメント

下記式より計算した。即ち、慣性モーメントは、各層の径（厚さ）及び比重から求めた計算値であり、ボールを球形と見なすことにより下記式により求めることができる。この場合、計算上ボールを球形にしているが、実際にはディンプルが存在するため、カバー層の比重は実際のカバー樹脂よりも小さくなる。ここではそれをカバー仮想比重と呼び、これを用いて慣性モーメントMを計算する。

$$M = (\pi / 5880000) \times \{ (r1 - r2) \times D1^5 + (r2 - r3) \times D2^5 + r3 \times D3^5 \}$$

M：慣性モーメント（g・cm²）

r1：コア比重

D1：コア直径

r2：中間層比重

D2：中間層直径（コアに中間層を形成した後の球体の直径）

r3：カバー層仮想比重

D3：カバー層直径（ボール直径）

*各直径の単位はmm

飛距離

スイングロボットを用い、ドライバー（#W1、ヘッドスピード45m/sec）で打撃し、キャリー、トータルそれぞれの飛距離を測定した。

スピン量

#W1及び#9アイアン（#I9、ヘッドスピード36m/sec）について、インパクト直後のボールの挙動を写真撮影し、写真解像により算出した。

フィーリング

#W1及び#I9について、プロゴルファー3名により実打したときの感触を下記基準により評価した。

○：軟らかい

△：やや硬い

×：硬い

【0047】

【表1】

ソリッドコア組成 (重量部)	実施例					比較例			
	1	2	3	4	5	1	2	3	4
ポリブタジエン*1	100	100	100	100	100	100	100	100	100
ジクミルパーオキ サイド	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
硫酸バリウム	7.6	10.5	8.3	3.3	13.6	18.9	21.1	12.8	20.6
亜鉛華	5	5	5	5	5	5	5	5	5
老化防止剤	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ペンタクロロチオ フェノール亜鉛塩	1	1	1	1	1	1	1	1	1
アクリル酸亜鉛	29.6	24.8	28.1	24.8	26.3	33.3	25.9	34.0	34.0

*1 日本合成ゴム社製 BR01
【0048】

*【表2】

中間層組成 (重量部)		ショアD	a	b	c	d	e	f	g	h
	T1190*2	40	100		100					
	T1180*3	30		100		100	100			
	ハイトレル4047*4	40							100	
	PEBAX3533*5	42						100		
	ハイミラン1706*6	63								60
	サーリン8120*7	45								40
	二酸化チタン				6	20				
	タングステン		4.5	14.5			4.5			

*2 大日本インキ化学工業社製 パンデックスT11
90 (ポリウレタン系エラストマー)

※ラストマー)

*3 大日本インキ化学工業社製 パンデックスT11
80 (ポリウレタン系エラストマー)

*6 三井・デュボンポリケミカル社製 ハイミラン1
706 (アイオノマー樹脂)

*4 東レ・デュボン社製 ハイトレル4047 (ポリ
エステル系エラストマー)

*7 デュボン社製 サーリン8120 (アイオノマー
樹脂)

*5 東レ社製 PEBAX3533 (ポリアミド系エ

【0049】

【表3】

カー バ ー 組 成 (重量部)		ショアD	A	B	C	D	E
	ハイミラン1605*8	63		50			
	ハイミラン1706*6	63	55	50		40	70
	サーリン8120*7	45	45		100	60	30
	二酸化チタン		5.13	5.13	5.13	5.13	5.13

*6 同上

★605 (アイオノマー樹脂)

*7 同上

【0050】

*8 三井・デュボンポリケミカル社製 ハイミラン1★

【表4】

1 1		実施例					比較例			
		1	2	3	4	5	1	2	3	4
コア	重量 (g)	27.52	27.82	27.52	26.60	26.54	30.25	27.47	29.72	30.76
	外径 (mm)	36.00	36.00	36.00	36.00	35.30	36.40	35.30	36.50	36.50
	10~130kgたわみ量 (mm)	3.65	4.15	3.70	4.15	3.95	3.00	4.00	2.90	2.90
	ショアD (表面硬度)	50	48	50	48	49	54	48	55	55
	比重	1.127	1.191	1.127	1.089	1.152	1.198	1.193	1.167	1.208
中間層	種類	a	b	c	d	e	f	g	g	h
	硬度 (ショアD)	43	35	43	35	35	42	40	40	56
	重量 (g) * 9	37.88	35.61	37.88	37.88	35.61	38.59	35.68	37.90	37.90
	外径 (mm) * 9	37.90	38.70	39.70	39.70	38.70	40.00	38.70	39.70	39.70
	比重	1.24	1.35	1.24	1.35	1.24	1.01	1.12	1.12	0.98
	ゲージ (mm)	1.85	1.35	1.85	1.85	1.70	1.80	1.70	1.60	1.60
カバー	種類	A	B	A	B	B	C	B	D	E
	比重	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
	ゲージ (mm)	1.50	2.00	1.50	1.50	2.00	1.35	2.00	1.50	1.50
	硬度 (ショアD)	55	63	55	63	63	45	63	53	58
ボール	重量 (g)	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3
	外径 (mm)	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
慣性モーメント (g・cm ²)		83.2	82.9	83.2	84.3	82.3	81.2	81.3	82.1	80.9
# W1 HS45	キャリアー (m)	208.8	209.0	208.8	228.7	229.0	205.9	207.9	205.8	207.9
	トータル (m)	222.5	223.5	222.3	223.0	223.3	217.5	221.0	218.1	219.2
	スピン (rpm)	2702	2565	2651	2499	2528	3001	2548	2898	2689
	フィーリング	○	○	○	○	○	△	○	△	○
# 19 HS36	スピン (rpm)	9076	8902	9064	8838	8876	9343	8335	8935	8566
	フィーリング	○	○	○	○	○	△	○	○	○
耐ささくれ性		○	○	○	○	○	△	○	△	△
連続耐久性		○	△	○	△	△	○	△	○	○

* 9 コア+中間層

【手続補正書】

【提出日】平成11年3月30日

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】0027

【補正方法】変更

【補正内容】

【0027】鎖延長剤としては、特に制限されず、通常の多価アルコール類、アミン類が用いられ、具体的には、1,4-ブチレングリコール、1,2-エチレングリコール、1,3-プロピレングリコール、1,6-ヘキシルエチレングリコール、1,3-ブチレングリコール、ジシクロヘキシルメタンジアミン（水添MDA）、イソホロンジアミン（IPDA）などが挙げられる。

【手続補正2】

【補正対象書類名】明細書

【補正対象項目名】0030

【補正方法】変更

【補正内容】

【0030】この場合、中間層は、上記ソリッドコアよりも軟らかく形成することが好ましく、特にショアD硬度でソリッドコアの表面硬度より6以上、更に好ましくは8~15小さく形成することが推奨される。このように中間層をソリッドコアより軟らかく形成することで、ソフトな打感を有し、しかも軟らかすぎずに芯を持った適度な打撃感を与えることができる。

【手続補正3】

【補正対象書類名】明細書

【補正対象項目名】0050

【補正方法】変更

【補正内容】

【0050】

【表4】

		実施例					比較例			
		1	2	3	4	5	1	2	3	4
コア	重量 (g)	27.52	27.62	27.52	26.60	26.54	30.25	27.47	29.72	30.76
	外径 (mm)	36.00	36.00	36.00	36.00	35.30	38.40	35.30	36.50	36.50
	10~130kgたわみ量 (mm)	3.65	4.15	3.70	4.15	3.95	3.00	4.00	2.90	2.90
	ショアD (表面硬度)	50	48	50	48	49	54	48	55	55
	比重	1.127	1.131	1.127	1.089	1.152	1.198	1.193	1.167	1.208
中間層	種類	a	b	c	d	e	f	g	g	h
	硬度 (ショアD)	43	35	43	35	35	42	40	40	56
	重量 (g) * 9	37.86	35.61	37.86	37.86	35.81	38.59	35.66	37.90	37.90
	外径 (mm) * 9	39.70	38.70	39.70	39.70	38.70	40.00	38.70	39.70	39.70
	比重	1.24	1.35	1.24	1.35	1.24	1.01	1.12	1.12	0.98
	ゲージ (mm)	1.85	1.35	1.85	1.85	1.70	1.80	1.70	1.60	1.60
カバー	種類	A	B	A	B	B	C	B	D	E
	比重	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
	ゲージ (mm)	1.50	2.00	1.50	1.50	2.00	1.35	2.00	1.50	1.50
	硬度 (ショアD)	55	63	55	63	63	45	63	53	58
ボール	重量 (g)	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3
	外径 (mm)	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
慣性モーメント (g・cm ²)		83.2	82.9	83.2	84.3	82.3	81.2	81.3	82.1	80.9
# W1 HS46	キャリア (m)	208.8	209.0	208.8	228.7	229.0	205.9	207.9	205.8	207.9
	トータル (m)	222.5	223.5	222.3	223.0	223.3	217.5	221.0	218.1	219.2
	スピン (rpm)	2702	2565	2651	2499	2528	3001	2548	2898	2689
	フィーリング	○	○	○	○	○	△	○	△	○
# I9 HS36	スピン (rpm)	9076	8902	9084	8838	8876	9343	8335	8935	8566
	フィーリング	○	○	○	○	○	△	○	○	○
耐さきくれ性		○	○	○	○	○	△	○	△	△
連続耐久性		○	△	○	△	△	○	△	○	○

* 9 コア+中間層

フロントページの続き

(51) Int. Cl.⁶

識別記号

F I

// C 0 8 L 23/26

C 0 8 L 23/26